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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/899,872 | 07/05/2001 | Enrico Griseri | CISCP690 | 6618 |

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EXAMINER

CUNNINGHAM, STEPHEN C

| ART UNIT | PAPER NUMBER |
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3663

DATE MAILED: 10/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/899,872

Applicant(s)

GRISERI ET AL.

Examiner

Stephen C. Cunningham

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2,4,6,7,9-12,19,21,22,24,26 and 27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2,4,6,7,9-12,19,21,22,24,26 and 27 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 June 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Drawings

The drawings have been accepted and the objection to the drawings has been withdrawn.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claim 2 is rejected under 35 U.S.C. 102(e) as being anticipated by Ackerman et al. ('963) (hereafter "Ackerman").

Regarding claim 2, Ackerman teaches an optical communication system, which includes an apparatus for amplifying an optical signal, comprising: (1) a fiber (see column 1, line 23); (2) an optical pump energy source disposed to inject optical pump energy into said fiber in a co-propagating direction relative to a transmission direction of an optical signal in said fiber to cause Raman amplification of said signal in accordance with a gain level (see column 3, line 65 to column 4, line 4); and (3) wherein said gain level is greater than 4 dB (see column 5, lines 47-48; column 7, line 7). While Ackerman does not explicitly teach that for a selected signal to noise ratio there is a greater four-wave mixing product than would be achieved using only a counterpropagating optical

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pump energy. Ackerman inherently teaches that when given a signal to noise ratio, there is a greater four-wave-mixing product suppression level than would be achieved using only a counterpropagating optical pump energy source to obtain said gain level. The inference stems from the fact that the only requirements for this to occur is that there be a co-propagating Raman pump imparting a gain of greater than 4 dB to the optical signals amplified therein. The claim requires (and in fact the Application, considered as a whole teaches) that the only things necessary to achieve the claimed result is a fiber, a co-propagating pump source, which imparts a gain of greater than 4dB. Thus, the "beneficial" (see Paper No. 4 at 22) four wave mixing product suppression is latent, ergo inherent in the apparatus of Ackerman, as Ackerman discloses all of the components and values claimed. Ackerman fails to disclose a gain level responsive to minimum tolerable four-wave mixing product suppression level and a desired signal to noise ratio. Vasilyev et al. teaches an optical amplifier wherein the pump powers are determined in response to minimum tolerable four-wave mixing product suppression and a desired signal to noise ratio. See figures 3B; 4B; paragraphs [0009] and [0011] – [0017]. It would have been obvious to control to modify the Ackerman apparatus by controlling the pump sources to optimize the system for minimum four-wave mixing and maximum optical signal to noise ratio.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 4, 6, 7, 9, 10, 11-12, 19, 21, 22, 24, 26, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cornwell, Jr. et al. ('383) (hereafter "Cornwell") in view of Ackeruran further in view of Vasilyev et al. (2002/0154389).

Regarding claims 4, 19, and 24, Cornwell teaches an optical amplifier in a fiber-optic communications system, comprising: (1) a first optical pump energy source (Fig. 5, first set of sources (from left to right), 12, right-hand source) disposed to inject optical pump energy into a fiber (Fig. 5, 36) in a co-propagating direction relative to a transmission direction of said optical signal to cause Raman amplification of said signal in accordance with a first gain level (the first gain level is inherent, as the first optical pump energy source will impart Raman gain to the signal, as it is designed to impart said Raman gain and must therefore be above the SRS threshold for the fiber); (2) a second optical pump energy source (Fig. 5, second set of sources (from left to right), 12, left-hand source) disposed to inject optical pump energy into said fiber in a counter-propagating direction relative to said transmission direction of said optical signal to cause Raman amplification of said signal in accordance with a second gain level (inherent for the same reason that the first gain level was inherent), and wherein said optical signal experiences a total gain level including a first gain and a second gain (this is also inherent because of the additive nature of net gain). Cornwell does not teach that the first gain level is greater than 4 dB. Ackerman teaches a first Raman pumping source that pumps a fiber so as to impart Raman gain on the optical signals that is

greater than 4 dB. It would have been obvious to modify the Cornwell amplifier to include a first pumping source that yields a gain of greater than 4 dB because such is well known in the Raman amplifier art and presents an amplification system with numerous benefits, as described in column 3, lines 40-49 of the Ackerman patent.

Additionally, Cornwell does not teach that when given a signal to noise ratio, there is a greater four-wave-mixing (FWM) product suppression level than would be achieved using only said second optical pumping energy to obtain said total gain level. Ackerman inherently teaches that this is the case. The discussion of claim 2, above is hereby incorporated by reference to support the determination that Ackerman inherently exhibits such phenomena.

Vasilyev teaches an optical amplifier wherein the pump powers are determined in response to minimum tolerable four-wave mixing product suppression and a desired signal to noise ratio. See figures 3B; 4B; paragraphs [0009] and [0011] – [0017]. It would have been obvious to modify the Cornwell reference to utilize the co-propagating Raman pumping system of Ackerman because of the numerous benefits to be obtained by such a modification such a reduced pump-signal cross-talk, which would have the inherent effect of yielding a beneficial FWM product (See Ackerman at column 3, lines 40-49); and to further modify the apparatus by controlling the pump sources to optimize the system for minimum four-wave mixing and maximum optical signal to noise ratio.

Regarding claims 6, 21, and 26, Vasilyev teaches an optical amplifier wherein the gain level is set responsive to a maximum tolerable saturation level. See figure 3B depicting pump power levels vs. gain showing a steep slope drop off at high pump

powers (inherently a higher saturation level) wherein the steep slope range results in unstable operation. It would have been obvious to modify the apparatus by controlling the gain level responsive to a maximum tolerable saturation level in order to maintain stable operation.

Regarding claims 11, Cornwell teaches a Raman amplifier that comprises a fiber (Fig. 5, 36).

Regarding claims 12, 22, and 27, Cornwell teaches an erbium-doped amplifier in cascade with the fiber. See particularly column 11, lines 22 to 32.

Claims 7, 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cornwell in view of Ackerman and Aoki (cited to show inherency).

Regarding claim 7, Cornwell does not teach that the second gain level is set responsive to said first gain level. This is an obvious modification to the Cornwell amplifier. First of all, it is well known that by increasing pump power the gain of the amplifier can be increased, which to a point, will increase the SNR of the amplifier and the amplifier gain. See generally, Aoki at 1227-28. It would have been obvious to modify the Cornwell amplifier to determine a total desired gain value, and set a second gain level in accordance with the first gain level because as is well known in the art, the total amplifier gain is a function of input pump power (Id.) and that by increasing the incident pump power (regardless of forward or backwards pumping) one would increase the gain of the amplifier to a desired gain, as would have been appreciated by one of ordinary skill in the art at the time of the invention by applicant.

Regarding claim 9, Cornwell inherently teaches that the first optical pump energy source is set in accordance with a first gain level. The purpose of using a Raman pump is to impart Raman gain on the optical signal, and by pumping above the SRS threshold; such gain is imparted to the optical signal. Cornwell inherently shows that the first pumping energy is set in accordance with a first gain because the first pump must be pumping above the SRS threshold (as it is intended to be a Raman amplifier).

Aoki illustrates the effects of forward pumping at various Raman pump powers to obtain a Raman gain, which shows that by pumping at a given pump level, the signal is amplified to first Raman gain level. See Fig. 4 of the Aoki article, at page 1227.

Regarding claim 10, see the discussion of claim 9.

Response to Arguments

Applicant's arguments with respect to claims 2, 4, 11-12, 15-17, 19, 22, 24, and 27 have been considered but are moot in view of the new ground(s) of rejection.

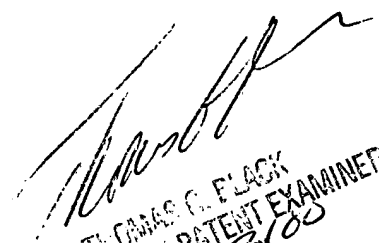
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen C. Cunningham whose telephone number is 703-605-4275. The examiner can normally be reached on Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas G. Black can be reached on 703-305-8233. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1113.

SCC


THOMAS G. BLACK
SUPERVISORY PATENT EXAMINER
GROUP 3663